

(12) UK Patent Application (19) GB (11) 2 169 195 A

(43) Application published 9 Jul 1986

(21) Application No 8600276

(22) Date of filing 7 Jan 1986

(30) Priority data

(31) 689268

(32) 7 Jan 1985

(33) US

(71) Applicant
Whittaker General Medical Corporation
(USA—California),
10880 Wilshire Boulevard, Los Angeles, California
90024, United States of America

(72) Inventor
Alfred H. Grebe

(74) Agent and/or address for service
Reddie & Grose, 16 Theobalds Road, London,
WC1X 8PL

(51) INT CL⁴
A47C 27/10 A61G 7/04

(52) Domestic classification (Edition H)
A4M 1B10 1B1 1B2 1B4 1B5 1B7 1B8

(56) Documents cited

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(58) Field of search
A4M
Selected US specifications from IPC sub-classes A47C
A61G

(54) Inflatable bed patient mattress

(57) A mattress (10) for bed patients includes a hollow, elongated, fluid-inflated mattress body (12) which may be permanently inflated or inflatable and deflatable by connection with a suitable inflation device. The mattress also includes a selectively inflatable patient support portion (24) which is disposed generally centrally of the mattress body (12) and is connected thereto. The support portion (24) includes a number of cells (26) which are individually connected to a device (30) capable of individually inflating and deflating each of the cells (26) to facilitate support of the patient's body, while lying on the mattress, and to minimise the development of bed sores. The support portion inflation device (30) preferably is both manually and automatically controllable. The cells of the support portion may be elongated, parallel, preferably transversely extending tubes (26), or a grid of inflatable pockets (26a) or the like. In one embodiment, the mattress body (12) comprises a number of contiguous, longitudinally extending tubes (14) connected to a manifold (18) and simultaneously inflatable and deflatable.

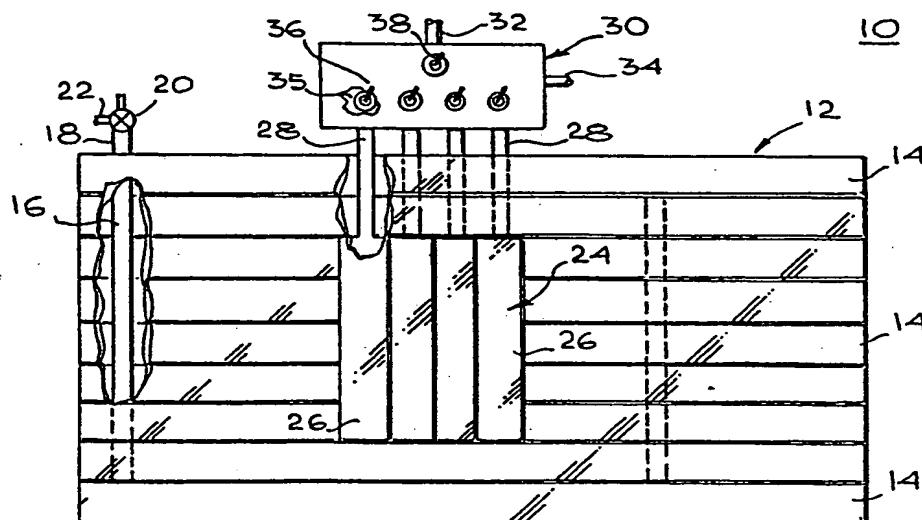


Fig. 1

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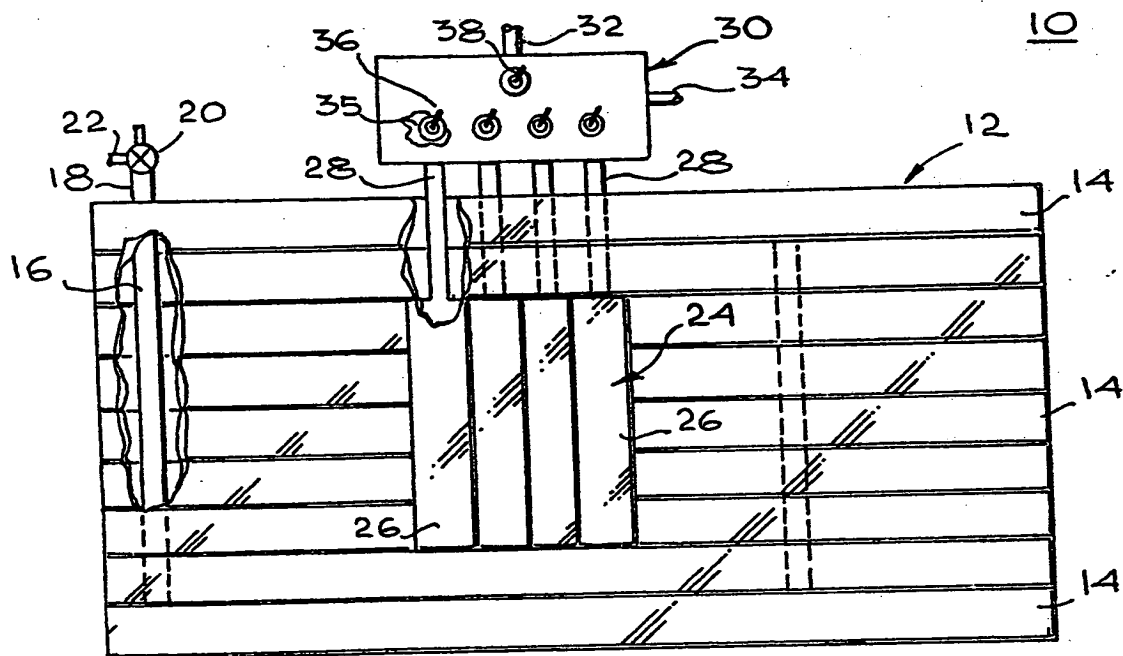


Fig. 1

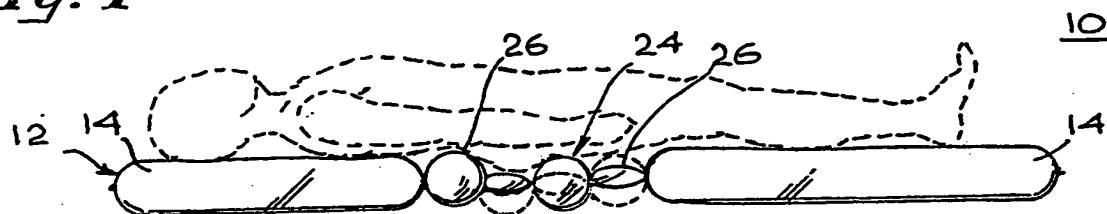


Fig. 2

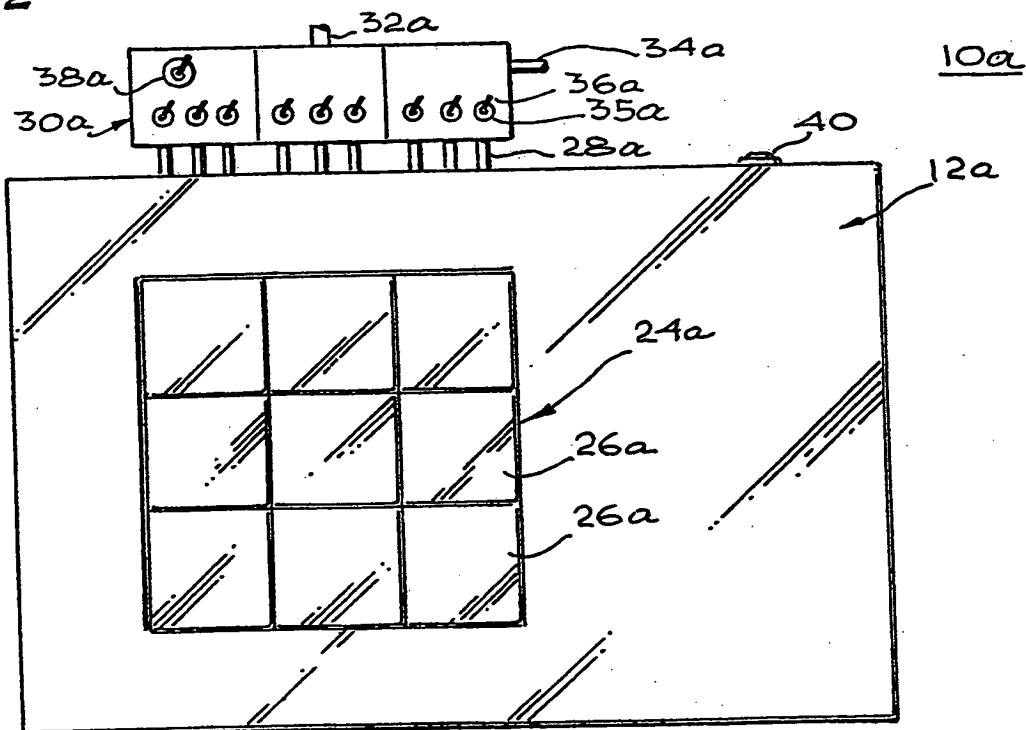


Fig. 3

SPECIFICATION

Impr ved inflatabl bed patient mattress

The present invention generally relates to patient support devices and more particularly to an improved mattress which is selectively regionally inflatable by the patient.

The problem of bed sores developing in patients lying for extended times on hospital beds is substantial. The problem is particularly severe in cases of patients in immobilised or comatose conditions due to surgery, injury and/or old age. In order to avoid bed sores in such circumstances, it is necessary to manually move the patient frequently to allow access of air to various parts of the patient's skin and to relieve continued pressure against those skin parts. This necessarily involves a considerable amount of time and cost on the part of hospital and nursing home personnel.

The bed sore or decubitus ulcer problem has been addressed recently by a number of inventions which involve the use of fluid-filled mattresses, which can be periodically inflated and deflated to intermittently support the patient at different points of the body, thus allowing periodic reduction of skin pressure and access to air. For example, U.S. Patent No: 3,199,124 is directed to an air mattress which has a plurality of tubes extending the full length of the mattress and which form two alternating sets. The tubes of one set are all inflated to the same pressure while the tubes of the other set are all deflated. Thus, the two sets alternately inflate and deflate in order to reduce the chance of bed sores. Unfortunately, the use of such a mattress does not eliminate the bed sore problem, particularly because the patient may move slightly and in so doing, recompress a skin area which has just been relieved of pressure by the deflation of a tube previously lying under the patient. Moreover, the pressure in the tubes is uniform throughout the length thereof and does not address the main problem which arises with such patients, because of the concentration of skin pressure in the bony back, hip and upper thigh regions where most of the patient's weight is supported. Decubitus ulcers may extend down through the skin right to the underlying bones.

US Patent No: 4,267,611 is directed to an inflatable mattress formed of two sets of tubes which are alternately inflated and deflated. The sets alternate with each other in position and are generally transversely disposed across the mattress. Those tubes are also of generally uniform thickness and support area except at the foot of the mattress. A similar transversely extending dual set of tubes of uniform size and length is disclosed in US Patent No: 2,998,817. US Patent Nos: 3,705,429 and 4,391,009 also disclose transversely extending sets of tubes of generally uniform size and length but of more complicated design than in the previously described patents. Even more complicated is the mattress configuration described in US Patent No: 4,279,004, which configuration is difficult to manufacture, repair and utilise. US Patent Nos: 3,740,777 and 3,000,539 disclose more exotic versions of body support systems.

All of the above-described devices fail to specifically treat and deal with those areas of the mattress which the main support points of the patient lie and also fail to deal with the likelihood that the patient may shift weight intermittently while lying on the mattress. Accordingly, the described devices fail to wholly eliminate bed sores in those patients most subject thereto.

US Patent No: 4,468,824 discloses an inflatable mattress which has a rectangular central area in the form of an opening or cavity totally devoid of patient support and positioned such that the main pressure areas of the patient, namely the lower back, hip and upper thigh, would be positioned over this cavity, thereby eliminating bed sores in this area. However, the mattress provides no physical support where it is most needed and therefore is totally impractical. Moreover, those areas of the patient's body bordering the cavity actually build up excessive pressure because they must serve as a support for the otherwise unsupported areas, overlying the cavity. Accordingly, danger of decubitus ulcers in those border areas is increased.

Accordingly, there is a need for an improved bed patient mattress which will essentially eliminate the development of bed sores or decubitus ulcers in patients who are most subject to the same. Such device should be simple and inexpensive to construct, use and repair and should also provide optimal physical support, regardless of whether the patient remains totally immobile or shifts his or her weight around on the mattress.

The improved inflatable bed patient mattress of the present invention satisfies all the foregoing needs. Accordingly the invention provides a mattress for bed patients comprising top and bottom portions and, intermediate the top and bottom portions, a selectively inflatable support portion comprising a plurality of selectively inflatable cells and inflation means individually connected to said cells for selectively inflating and deflating said cells by introduction or removal of fluid.

Preferably the mattress comprises an elongated mattress body which is filled with fluid, either permanently or such as to be periodically inflated or deflated, as desired. The mattress body can, for example, comprise a plurality of longitudinally extending contiguous tubes connected to the manifold of an air compressor for simultaneous inflation or deflation to the desired degree, depending upon the weight and size of the patient and the overall need for support of the patient's body. The mattress body defines and surrounds a generally central patient support component which is connected thereto. The patient support component is positioned so that it is designed to underlie that area of the patient's body which extends from the lumbar region, through the hip and buttocks and upper thigh, that is, those areas of the patient which support the majority of the patient's weight and are most bony and therefore which are most subject to the development of bed sores.

The patient support component comprises a plurality of transversely extending tubes or cells which are individually inflatable and deflatable and

are connected to control means which can be operated by the patient manually, or can be placed in an automatic mode which alternately inflates and deflates selected areas of the support to eliminate or greatly reduce bed sores.

The support component in one embodiment comprises a grid of cells; for example, three rows of three cells each for a total of nine cells, each of the individual nine cells being individually connected through the control means to a pressure source. With this arrangement, when a patient lies on a bed covered by the mattress, that patient will directly overlie the patient support component and can control the particular amount of physical support provided by a given area of the patient support component merely by operating the controls to the individual cells in the support component. Should the patient change position laterally or longitudinally, or both, as by rolling over, the patient can then readjust the alignment of inflated and deflated cells of the support component to provide the desired physical support but also prevent the development of the bed sores. When the patient is asleep, the mattress support component can be placed in an automatic mode, whereby the cells thereof individually cycle between inflation and deflation, adjoining cells in a longitudinal or transverse array at any given time being in opposite modes of pressurisation — depressurisation.

In one embodiment, the main bulk of the mattress outside of the patient support component described above is permanently inflated, while in another embodiment, it is inflated or deflated to a controlled degree by a suitable lever so as to provide desired physical support to patients of different sizes and weights, etc. The mattress can be made inexpensively of a durable airtight cloth, such as rubberised cloth, or rubber, plastic or similar component(s) and the controls for the mattress can be relatively inexpensive conventional valve control means, electrically, hydraulically or mechanically operated. Alternatively the mattress body can be formed as a conventional mattress with the support portion intermediate the ends of the mattress.

The invention will now be described in greater detail by way of example with reference to the drawings in which:

Fig. 1 is a schematic top plan view, partly broken away, depicting a first preferred embodiment of the improved inflatable bed patient mattress of the present invention;

Fig. 2 is an enlarged, fragmentary schematic side elevation of the mattress of Fig. 1, showing a patient in dotted outline lying on the mattress and two of the four transverse tubes of the patient support component in the mattress in the inflated condition while the other two tubes thereof are in the deflated condition; and,

Fig. 3 is a schematic top plan view of a second preferred embodiment of the improved inflatable bed patient mattress of the present invention.

Now referring more particularly to Figs. 1 and 2 of the accompanying drawings, the first preferred embodiment of the improved inflatable bed patient mattress of the present invention is schematically

depicted therein. Thus, mattress 10 is shown which comprises a hollow, rectangular mattress body 12, comprising a plurality, specifically nine, parallel, longitudinally extending, contiguous, hollow

inflatable tubes 14, connected by a single transverse passageway 16 to a single valved outlet 18 running to a source of air pressure (not shown). Thus, all of tubes 14 are simultaneously inflatable to the desired degree by air entering through valved entry 18 and passing through passageway 16 in body 12. When a valve 20 in line 18 is turned by the patient or hospital attendance in a pre-selected direction, mattress body 12 can either be inflated or deflated. The exhaust line for this arrangement is shown as tube 22 connected to valve 20. Thus valve 20 is a three-way valve, providing in the three positions, alternately, access to pressure, exhausting of pressure or blockage of line 18 to retain pressure. If desired, valve 20 can be electric solenoid-operated in order to reduce the physical effort which needs to be exerted by the patient or nurse to operate valve 20. It will be understood that the extent of pressure to be exerted by tubes 14 on a patient lying on the same can be varied according to the need of the patient, as dictated by the patient's size, shape, weight and medical condition and the limit of pressure available from the compressor.

Mattress 10 also includes a selectively inflatable patient support component 24, which is disposed generally centrally of mattress body 12 and surrounded by and connected to it either integrally or separately. Thus, if desired, component 24 can be releasably connected by body 12, and body 12 and/or component 24 can be replaced when worn, damaged, etc.

Support component 24 is specifically dimensioned and located to preferably underlie the lumbar through upper thigh regions of the patient lying on mattress 10 and comprises a plurality, in this instance four, of transversely extending individually inflatable contiguous tubes or cells 26. Each cell 26 is connected by a separate pressure line 28 to a control panel 30 which is in turn connected to a pressure supply source (not shown) by a supply line 32. Panel 30 also includes a pressure exhaust line 34. Panel 30 further includes a three-way valve 35 for each of cells 26. Each valve 35 is connected to both pressure supply line 32 and pressure exhaust line 34, so as to be able to individually control the amount of pressure, if any, in each cell 26 at any given time. If desired, exhaust line 34 could be eliminated and air could be continuously bled out of pinholes (not shown) piercing cells 26, and fresh air could be continuously supplied to cells 26 by pressure lines 28. Air passing out such pinholes could be used to evaporate perspiration from the patient's skin. Controllers 36 are shown extending from valves 35 through the upper surface of panel 30 so as to permit the patient and/or medical personnel to individually adjust the pressure in each of cells 26.

Panel 30 also includes a conventional automatic pressure control system (not shown) operated by lever 38, necessary to place all of cells 26 in an automatic cycle of inflation and deflation, wherein

adjoining cells 26 preferably are in opposite modes of inflation and deflation at any given time. This automatic cycle is used when the patient is asleep and assures that the maximum pressure points for the patient's body tissue, that is, those overlying region 24, will periodically alternately undergo full physical support (high skin pressure) in the inflation stage of the cycle for each cell 26 and low physical support (minimal skin pressure) in the deflation stage of the cycle of each cell 26, so as to eliminate the development of bed sores. While the patient is awake, he or she or a nurse can separately control the individual pressure in each of cells 26 for a maximum comfort and physical support and should the patient shift his or her position, he or she or a nurse can easily readjust the individual pressure in various of cells 26 to suit the occasion.

Accordingly, mattress 10 affords the maximum of individualised pressure adjustment for physical support of the patient while eliminating the development of bed sores, particularly in those areas of the patient's body most subject to the same. Those areas are the ones in which most of the patient's body weight is pressed against the underlying support. It will be understood that the size of support component 24 could be changed in order to suit changes in the mattress and patient size, etc. In some instances, it may be desirable to extend support components 24 to bridge the entire width of mattress 12.

A second preferred embodiment of the improved inflatable bed patient mattress of the present invention is schematically presented in Fig. 3 of the accompanying drawings. Thus, mattress 10a is shown. Components thereof which are similar to the components of mattress 10 bear the same numerals but are succeeded by the letter "a". Mattress 10a includes a hollow flexible resilient mattress body 12a which is permanently or adjustably inflatable to a desired level through an access port 40. It will be noted that mattress body 12a does not include a plurality of longitudinally extending tubes, as called for in mattress 12, but instead is a single large unsegmented enclosure or air or water bag.

Mattress 12a defines a patient support component 24a comprising nine contiguous cells 26a which are generally rectangular and are disposed transversely of mattress 12a in a grid pattern as shown in Fig. 3. Each cell 26a is individually connected by means of its own tube 28a to control panel 30a so that there are a total of nine tubes 28a leading to separate three-way valves 35a disposed within panel 30a and connected to individual control switches 36a for each cell 26a. Valves 35a are also connected to a pressure supply line 32a and to a pressure exhaust line 34a passing in panel 30a. Thus, with this arrangement, the individual pressure in each cell 26a is controlled by the patient and/or the hospital personnel by a switch 36a. Cells 26a can be placed in an automatic cycle of periodic alternate inflation and deflation by operation of an automatic control lever 38a shown in Fig. 3 on the top of control panel 30a.

The method of operation and advantages of device 10a are similar to those of device 10, except that component 24a is divided into nine cells 26a

rather than four transverse tubes 26 as in Fig. 1. Accordingly, more localised regional pressure control for enhancing patient support and elimination of bed sores is provided by device 10a.

It will be understood that various other embodiments of the improved mattress of the present invention can be provided while utilising the basic principles of the invention. Thus, the described valve controls can be mechanical, hydraulic or electrical. Various areas of the mattress body itself in addition to the support region can be made to automatically alternately inflate and deflate. In all instances, however, the highly individualised pressure areas within the central patient support component described above distinguishes this invention from conventional mattresses.

CLAIMS

1. A mattress for bed patients comprising top and bottom portions and, intermediate the top and bottom portions, a selectively inflatable portion comprising a plurality of selectively inflatable cells and inflation means individually connected to said cells for selectively inflating and deflating said cells by introduction or removal of fluid.

2. A mattress according to claim 1, wherein said top and bottom portions are fluid inflatable.

3. A mattress according to claim 1 or claim 2, wherein said top and bottom portions are connected together by side portions of the mattress to form a mattress body and the support portion is received in the cavity between said top, bottom and side portions.

4. An inflatable bed patient mattress, said mattress comprising, in combination:

- a) a hollow elongate fluid-inflated mattress body;
- b) a selectively inflatable patient support component disposed generally central of,

surrounded by said mattress body and connected thereto; said patient support portion including a plurality of individually inflatable cells; and,

c) support component inflation means individually connected to each of said cells to facilitate patient body support and minimise development of decubitus ulcers.

5. A mattress according to any one of claims 1 to 4, wherein said patient support portion is disposed in said mattress body at a location and in a size to underlie those portions of a patient's body, when lying on said mattress body, which extend from about the lumbar spinal region to the upper thigh region.

6. A mattress according to any one of claims 1 to 5, wherein said support portion inflation means includes means for both manually controlling selective inflation and deflation of said cells and for automatic cycling of inflation and deflation of said cells.

7. A mattress according to any one of claims 1 to 6, wherein said mattress body and said support portion are generally rectangular, and said mattress body comprises a plurality of contiguous, longitudinally extending inflated tubes and said

support portion comprises a plurality of contiguous transversely extending tubes.

8. A mattress according to any one of claims 2 to 7, wherein a single manifold controls the inflation and deflation of said mattress body.

9. A mattress according to any one of claims 2 to 7, wherein said mattress includes a portion which is permanently inflated.

10. A mattress according to any one of claims 2 to 7, wherein substantially all of said mattress is permanently inflated, said mattress body having a higher inflation pressure than said patient support portion.

11. A mattress according to claim 1, substantially as described herein with reference to Figs. 1 and 2, or Fig. 3 of the drawings.

Printed for Her Majesty's Stationery Office by Courier Press, Leamington Spa. 7/1986. Demand No. 8817356.
Published by the Patent Office, 25 Southampton Buildings, London, WC2A 1AY, from which copies may be obtained.